THE ERUPTION OF VESUVIUS OF APRIL, 1906.[1]

FOR thirty years Dr. Johnston-Lavis has devoted much of his life to the investigation and elucidation of volcanic phenomena as illustrated by the classical type-volcano Vesuvius. To him we owe the great geological map of Vesuvius and Somma, and a detailed memoir in which he worked out the geology of that very complex Neapolitan volcano, as well as numerous papers upon several eruptions.

FIG. 1.—The aspect of the great cone of Vesuvius on May 4, 1906, as seen from the Punta del Nasone on M. Somma looking due south. The dotted line is that of the outline of Vesuvius in October, 1903, taken with the same camera and lens, and represents, except for a faint variation at the extreme summit, the actual outline of the cone before it was truncated by the late eruption.

In a monograph lately issued by the Royal Dublin Society we have a careful vulcanological study of the great paroxysm of 1906, and an attempt to read from the recorded phenomena and the ejected materials the physics of such an eruption.

A quarter of a century ago, and in frequent communications since, Dr. Johnston-Lavis has pointed out that in the ejecta, and especially in the fragmentary materials, we have a key for interpreting the physical causes and phases of an eruption.

He holds that the aqueous and other vapours of an igneous magma are derived from materials acquired and dissolved by the igneous paste on its way towards the surface. There is evidence that the H_2O and other volatile elements really exist in the form of a solution of gases in a liquid, and that variations in the phases of an eruption are due to the separation of such volatile materials from solution and the expansion to the gaseous state on the relief of pressure or the increase of the amount and resulting tension of them. He maintains that the same physical laws that govern the solution of CO_2 in water under varying pressure and temperature are identical with those which govern the solution of H_2O, volatile chlorides and sulphates in a mixture of fused silicates.

This is the thesis that the author follows in the description of the last great outburst of Vesuvius, and still further claims his old favourite as the type-volcano of the world.

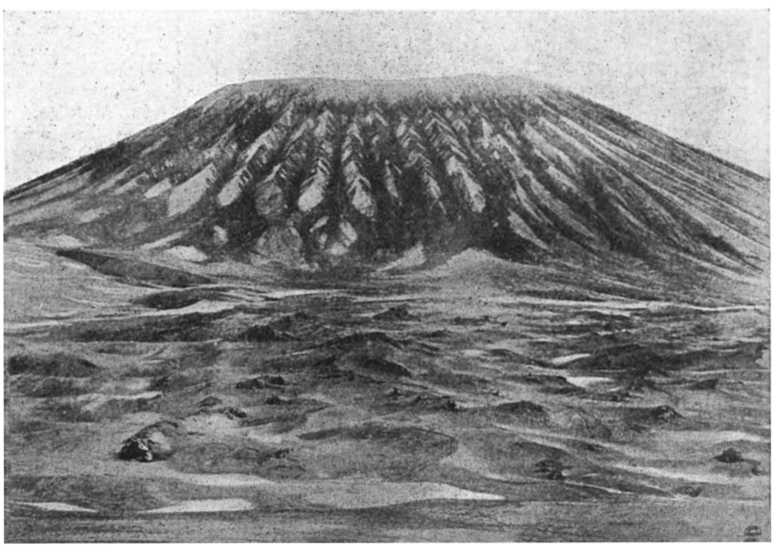

FIG. 2.—The great cone of Vesuvius as seen from the west at the foot of the Colle Umberto, looking due east across the Atrio on May 3, 1906, to show the truncation of its top and the remarkable barrancos formed on its sides by the slipping of loose fragmentary ejecta.

In the first chapter is a review of the changes that have occurred at Vesuvius since 1872, the date of the last important eruption. Next follows a diary of the daily and hourly changes at the volcano during its great paroxysm, partly from Dr. Johnston-Lavis's own observations and partly from those of other observers. The observations are then analysed in a chapter on general considerations and a scheme of grades and varieties of the activity of volcanoes is given, in which the eruption of April is classed under the *paroxysmal vesuvian* type, as distinguished from ordinary Vesuvian type. A protest is made against the application of the terms *vulcanian* and *pelean* to this outburst, the term being considered to be more applicable to acid volcanoes, in which the higher viscosity of an acid magma gives rise to a very different series of phenomena, namely, (*a*) amount of lava above the lateral outlet; (*b*) the secular output of lava; (*c*) the rise of magma due to its expansion from increased vesiculation after the relief of pressure from the fluid column above it has drained or blown away. The different phases of the eruption are studied, and the varying output of lava examined from these points of view.

The lava in this eruption was of the usual *aa* type of Vesuvian rapid outflows, and differs from the *pahoehoe* type of slow dribblings such as built up the great lava cones of 1891 and 1895. A comparison of microscopic characters shows that the felspars are more developed in the slow outflows, whilst the leucites dominate in the rapid floods of lava. A series of excellent photographs taken by the author exhibit many striking phenomena of lava flows on the open slopes, along narrow ravines, and amidst streets, houses, railroads, bridges, &c.

The so-called bombs which are frequent on the surface of lava streams were shown by the author some years ago to be due to the fragments of solid materials caught in the lava stream and floated to the surface by the vesiculation on their surface, which latter acts in a catalytic manner. They have condensed on their surface a crust derived from the fluid rock which gives them their bomb-like appearance. A photograph is given in which the nucleus is composed of a piece of wall, thus indicating their true origin. The author aptly compares them to a dumpling, and proposes in future to call them by that name to distinguish them from other so-called bombs.

Several reasons are given for the slight variations in the composition of the lavas, scorias, and dusts, such as the effect of aërial sorting, loss of chloride and sulphates, or the acid radicles of such salts leaving the bases behind, fumarolic exhaustion, &c., which are each reviewed in turn.

[1] Scientific Transactions of the Royal Dublin Society, vol. ix. (Series ii.), part 8. (Dublin: University Press.)

Two plates are devoted to a series of detailed sections of the fragmentary materials as distributed around the volcano, and the conditions that influenced the distribution of such materials are discussed.

The essential ejecta are shown to be represented by two strata of brown and black scoria that form the base of the great sheet of lapilli which covered the north-east sector of the volcano, and were so destructive to Ottajano, S. Giuseppe, and other towns. These were followed by the still more important and larger volume of the accessory ejecta derived from the fragmentation and ejection of the upper part of the great cone. One-third of that great cone has gone, as can be seen by the photographs in some of the plates, and a tremendous crater half a mile in diameter and of unknown depth afforded these materials.

The remarkable photographs of the great cone showing this truncation, compared with its original outline and that of the new crater at different dates, make impressive pictures. Plate V. of the memoir, here reproduced in Fig. 2, will remain as a classical view of the general shape of the cone with its scored sides, and Plate VI. of the details of those remarkable barrancos that are like the pleats in a half-opened umbrella. This scoring of the slopes of volcanoes was formerly supposed to be due to aqueous erosion, but is shown in this eruption to be caused by the slipping down of avalanches of loose

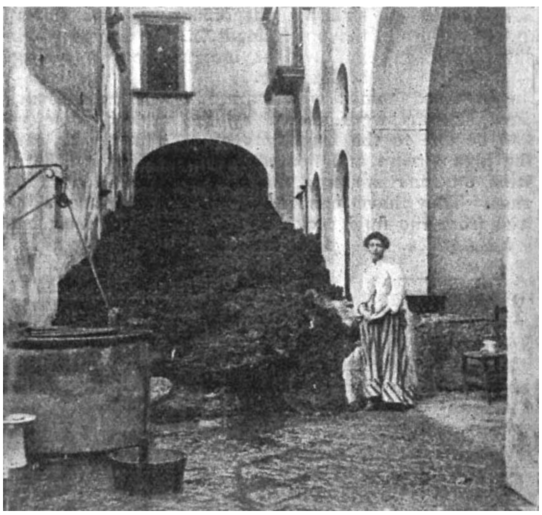

FIG. 3.—Lava that invaded the court of the villa of M. and T. Borosio at Boscotrecase.

fragmentary materials piled on the steep slopes of the cone towards the end of the eruption, when the ballistic energy was unable to throw them farther afield.

Some remarkable "hollow dykes," first described in the 1885 eruption, are given on p. 185, and the mechanism of their formation explained. The author believes they were possibly the canals by which issued the lavas of the Colle Margherita and the Colle Umberto.

The microscopic and other characters of the essential ejecta are illustrated by some plates of photomicrographs. The size of the vesicles, the relative amount of glass, microliths, and state of the magnetite are shown to indicate the position of the magma in the volcanic conduit, the amount of volatile constituents it acquired or lost at different depths, and their relationship to the different phases of the eruption.

The minerals and other eruptive products of the eruption are described in so far as they bear on the interpretation of the eruptive phenomena, but the author avoids petrographical and mineralogical details that he considers have no special bearing on the study of this outburst.

In addition to a large number of reproductions from photographs taken by the author, there are plans, figures, and maps. The last plate is a plan, on the scale of 1/10,000, of the modifications wrought in the cone and crater, printed specially for this memoir by the Istituto Geografico Militare of Italy.

TANTALUM AND ITS INDUSTRIAL APPLICATIONS.[1]

WHEN the announcement was made in the year 1878 that "the division of the electric light had been successfully accomplished," many people believed that the days of lighting by gas had come to an end, and acted accordingly, much to their own disadvantage, for the competition of the glow-lamp served only to stimulate its rival to new life. Burners of improved construction, regenerative burners, and finally gas mantles, helped to restore to gas the ground it had lost, and until a short time ago even threatened to check the spreading of electric lighting.

Not only this growing competition of gas, but the universal necessity of cheapening the production of commodities that are for general use, forced electrical engineers to study in all its aspects the question of improving the efficiency of electric lighting. As a guide in their researches they had the well-known principle that the illuminating power of a solid body increases at a much greater ratio than its temperature, or, in other words, that with the increase of temperature a greater percentage of the energy expended for heating the body is converted into light. There is plenty of room for improvement, for even the most economical source of light, the electric arc lamp, converts only about 1 per cent. of the energy of the electric current flowing through it into light, the rest appearing as heat, so that in reality all methods of lighting devised by men are to a much greater extent methods of heating.

The first successful incandescent lamp consisted of a carbon filament, and for a long time carbon appeared to be the only suitable substance, although the temperature to which such a filament can be raised is limited to about 1600° C., as above this point the carbon begins to disintegrate rapidly. At this temperature the lamp consumes from three to three and a half watts per candle-power, while any attempt to produce light more economically by raising the temperature of the filament results only in shortening its life and destroying, thereby, its power of competing with gas lighting.

An improvement on this result was introduced by Prof. Nernst, of Göttingen, who suggested as the source of light refractory earths, similar in character to those used for gas mantles, which, however, conduct electricity only when they are hot. Lamps constructed on Prof. Nernst's principle have, therefore, to be fitted with contrivances for heating their filaments when starting, which complicate the construction of the lamp.

Another step forward was made by the invention of the osmium lamp, which is produced in a somewhat similar manner to the carbon lamp, by squirting a plastic mixture of metallic oxide and a reducing agent into the shape of a filament, which is gradually heated in a glass bulb by the passage of an electric current, while the bulb is being exhausted by an air-pump or an equivalent device. So far as utilisation of energy goes, these lamps are a great improvement on carbon lamps, but their filaments are very brittle, and the total production of osmium per year is only about 8 kg. for the whole world, of which 5 kg. are required for medical purposes.

In January, 1905, Dr. W. von Bolton, the head of the chemical laboratory of the firm of Siemens and Halske, announced in a lecture to the Elektrotechnische Verein of Berlin that he had succeeded in producing pure tantalum, and his discourse was followed by Dr. O. Feuerlein describing how tantalum had been utilised for filaments in the lamp works of the firm. These discourses presented the result of long years of research work based on the general principle already alluded to, that that filament would give the best economical results which could be maintained for the longest time at the highest temperature.

The number of substances capable of conducting electricity and of sustaining such high temperatures is very limited, and platinum, the most refractory of the well-known metals, had been tried and found wanting. It became, therefore, necessary to start the research by

[1] Discourse delivered at the Royal Institution on Friday, April 23, by Alex. Siemens.